July 10, 1956 E. F. KLEINSCHMIDT ET AL 2,754,364

KEYBOARD TRANSMITTER

Filed June 14, 1951 3 Sheets-Sheet 1

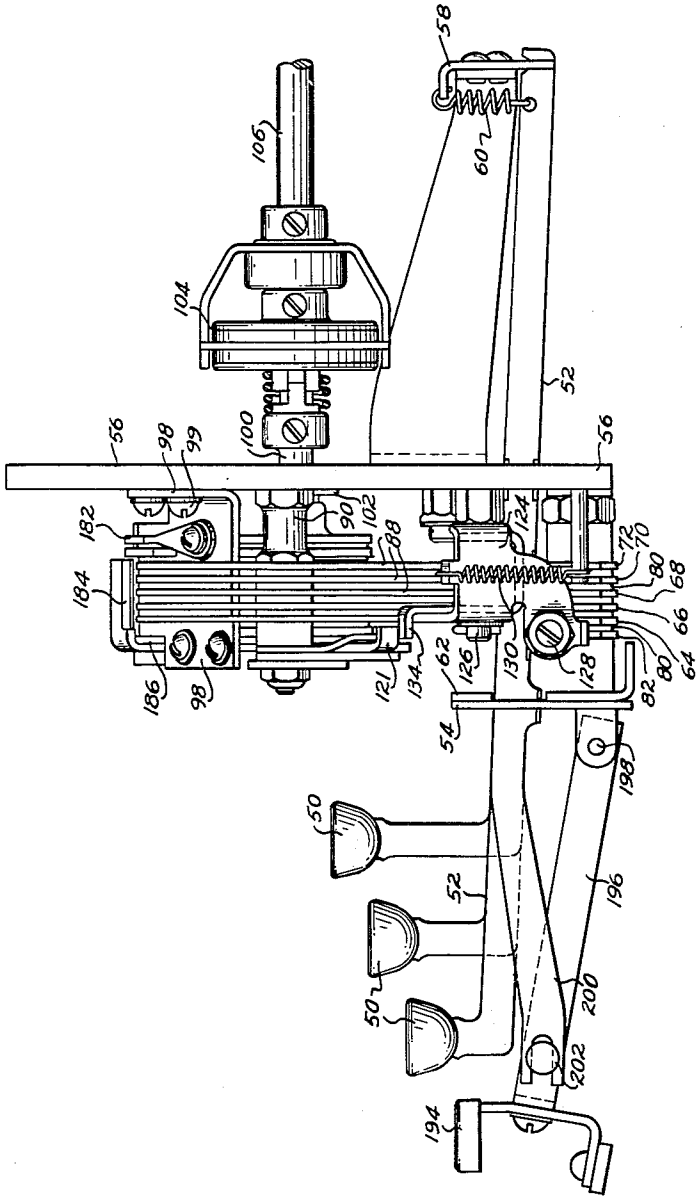


Fig. 1

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KEYBOARD TRANSMITTER

Filed June 14, 1951 3 Sheets-Sheet 2

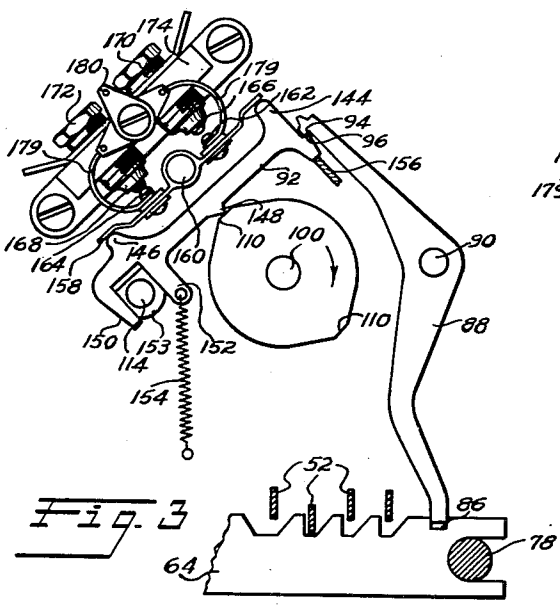


Fig. 3

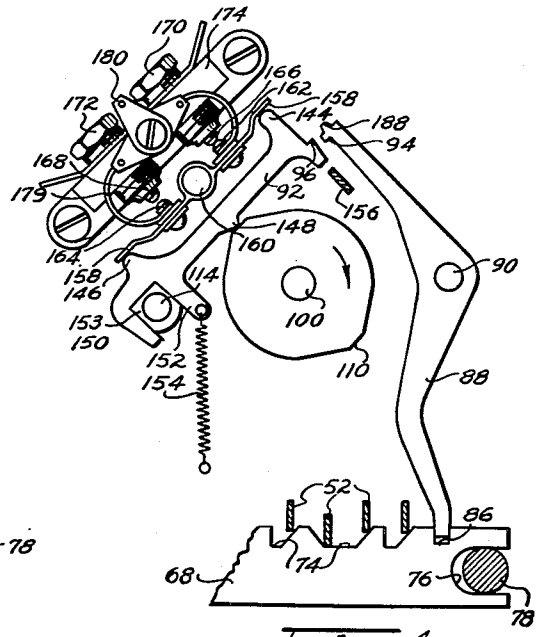


Fig. 4

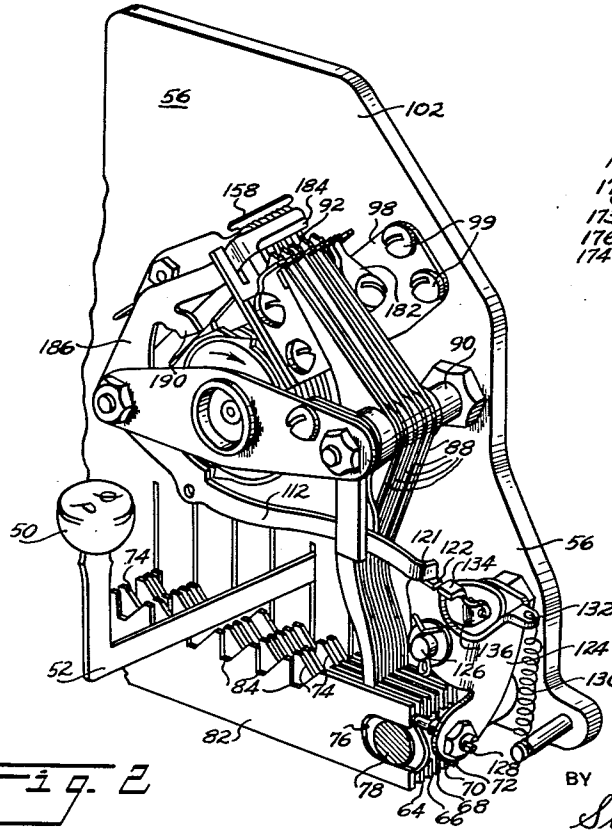


Fig. 2

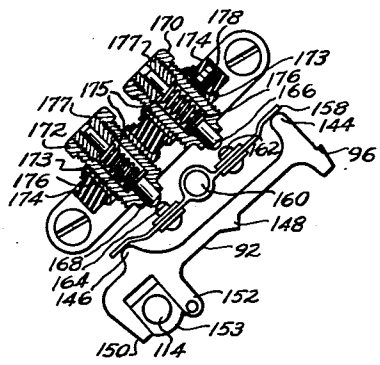


Fig. 9

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KEYBOARD TRANSMITTER

Filed June 14, 1951 3 Sheets-Sheet 3

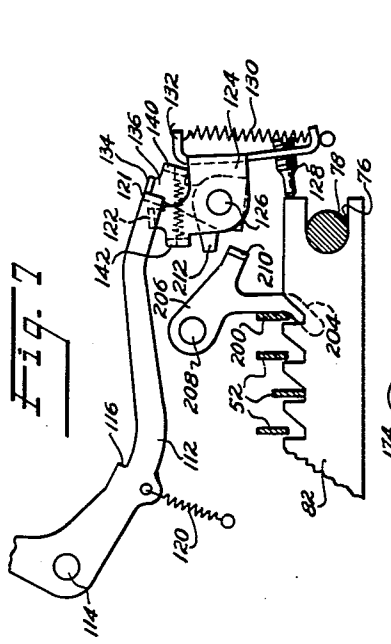


Fig. 7

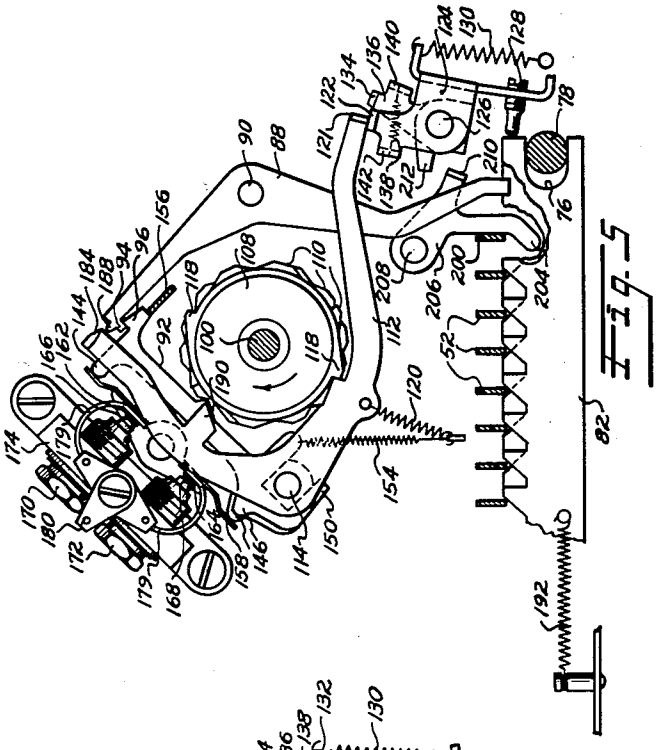


Fig. 5

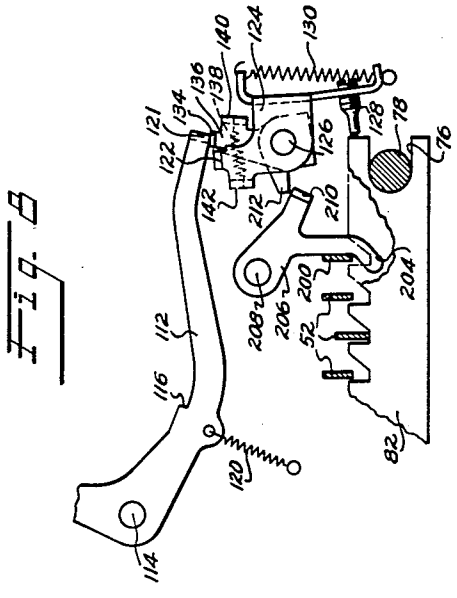


Fig. 8

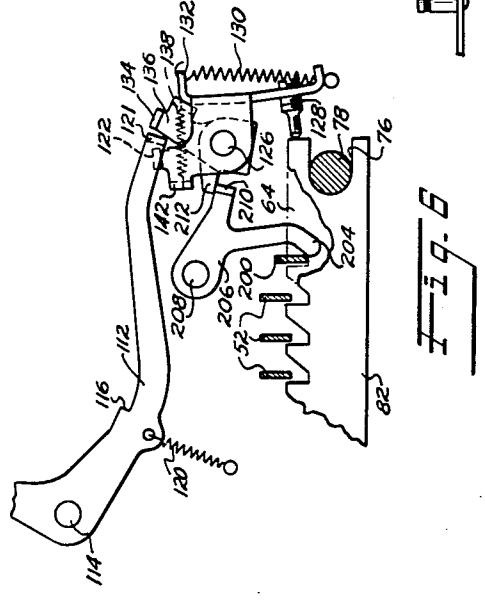


Fig. 6

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2,754,364

KEYBOARD TRANSMITTER

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Application June 14, 1951, Serial No. 231,554

24 Claims. (Cl. 178—79)

This invention relates to transmitters for printing telegraph systems and more particularly to transmitters which are controlled by and integral with an associated keyboard.

The preferred embodiment of this invention is adapted for use with a telegraph system of the start-stop type, wherein the signals comprise permutations of impulses corresponding to two different line conditions extending throughout a definite number of time intervals. The selecting intervals or impulses of each signal are preceded by a starting interval or impulse of uniform line condition and followed by a stopping or rest impulse or interval which is always the same and of opposite line condition from that of the starting interval or impulse.

The two different line conditions are customarily referred to as intervals during which marking or spacing impulses are transmitted. The marking impulses correspond to intervals during which current is transmitted and the spacing impulses correspond to intervals during which current is not transmitted. Usually the start interval consists of a spacing impulse and the stop or rest interval consists of a marking impulse. In certain instances polarized systems are used wherein the telegraph signals are formed by reversing the direction of current flow instead of interrupting the current flow. Thus the marking impulse will comprise a current flow in one direction and the spacing impulse a flow of current equal in value but in the opposite direction. Ordinarily the Baudot code is used in telegraph printer systems. It consists of a start pulse, five permutated impulses, and a stop pulse. Other systems use a six or seven unit code in addition to the start and stop impulses.

In signal transmitters for printing telegraph apparatus it has become increasingly important, as the speed of operation increases, to provide mechanisms that will accurately space the signals according to a pattern and prevent any bounce of the electrical contacts so that perfect make and break or positive and negative signals may be transmitted at high speed. The transmitters of the prior art, such as the multi-contact type transmitter disclosed in U. S. Patent No. 2,135,377 to Dirkes et al., worked fairly satisfactorily with telegraph printers limited to receiving fifty or sixty words per minute. However because of the tremendous demand for the use of telegraph lines, and because of the rapid advances made in the associated arts and the need for increasing the speed of conveying intelligence in regard thereto, such a rate of speed is no longer satisfactory particularly where the machines are used by the Armed Forces of the United States. Accordingly we have developed a keyboard transmitter which operates with a telegraph printer which will print one hundred words per minute and which has been accepted by the Signal Corps of the United States Army as its standard telegraph printer.

In telegraph printers in the past the transmitter comprised either a distributor having a rotating arm or brush which passed over a series of contact segments, or a group of contact springs equal in number to the impulse

units of the particular code in use. For many reasons such transmitters were unsatisfactory especially when operated at high speeds. In the distributor type the brush was a constant source of trouble, and in the multi-contact type the many contacts required constant adjusting and introduced difficulties in producing accurately spaced signals free from the effect of bouncing contacts.

We have overcome the difficulties inherent in such transmitters by providing for page and tape printers a single pair of positively actuated contacts of novel anti-bounce construction, having a single contact operating bail which is common to all of the code selecting levers. With this construction we have eliminated the necessity of constantly adjusting many sets of contacts and the poorly spaced signals so frequently caused thereby. It has also been customary in the prior art transmitters to have the rotatable member make a complete revolution for each code combination of impulses transmitted. When faster operation was desired the entire machine was speeded up to make the rotatable member turn at a higher speed with the result that the machine parts became unable to withstand the increased strain and wear. We have overcome the above problem by increasing the number of code transmissions made in one revolution, thus maintaining reasonable speeds while accomplishing more work per revolution. This has been accomplished by providing relatively large cam sections each having two or more cam lobes so that at least two characters may be transmitted in the course of one complete revolution of the cam sections as will be more fully explained hereinafter. Thus, without materially increasing rotational speeds and strains the output and efficiency of our transmitter is greatly increased by taking advantage of the increased lengths and peripheral speeds of the cam sections.

Accordingly, it is a primary object of this invention to provide a signal transmitting mechanism in which the transmitting contacts are operated by a positive motion under control of a transmitting cam unit and to provide means for accurately spacing the signals as well as to prevent "bounce" when a contact is made or broken.

Another important object of our invention is to provide a keyboard transmitter in which the speed of operation has been greatly increased by transmitting the code combination of impulses representing one character during one-half revolution or less of the rotatable member. This arrangement permits a greatly increased output without increasing the speed of rotation of the mechanisms involved.

A further object of this invention is to provide a keyboard controlled transmitting mechanism of great simplicity, improved efficiency and prolonged life which will transmit to a telegraph circuit combinations of code impulses corresponding to and representing actuated key levers.

A still further object of this invention is to greatly simplify the construction, operation, and maintenance of a keyboard and transmitter by providing a single set of contacts for controlling the line condition, thereby eliminating the formerly used plurality of transmitting contacts.

Another object of this invention is to provide a keyboard and transmitter having electrical contacts operated by a set of levers having two different mechanical motions and sequentially operated by one-half revolution or less of a rotatable member to send current impulses corresponding to an actuated key lever.

Another object of this invention is to provide a keyboard and transmitter including a universal bar operable when any key is depressed to start the transmitter operating and returned, as soon as the key is released, to its normal position by spring means to insure its

readiness for a subsequent operation when the next operated key is depressed.

A further object of the invention is to provide a non-repeat means to prevent repeated transmittal of the same code group if a key is held depressed for too long a time.

A still further object of the invention is to provide a mechanism to render the non-repeat means ineffective when the space-bar is actuated so that the spacing operation will be repeated until the space-bar is released.

Another object of this invention is to greatly reduce the manufacturing and maintenance costs of telegraph printers by designing certain of the parts for interchangeable use in other types of printing mechanisms as well as in various other portions of the same machine so that such parts may be manufactured in large quantities and their cost thereby minimized. In particular the same selecting control levers are used and the same operating principles are applied in the signal transmitting apparatus as are used in the selector mechanism disclosed in copending application Serial Number 190,359 filed October 16, 1950, by Edward F. Kleinschmidt.

A more complete and thorough understanding of the invention may be had from the following detailed description in conjunction with the accompanying drawings forming a part of this specification showing preferred embodiments thereof in which like reference characters indicate like parts and in which:

Figure 1 is an end elevation of a preferred embodiment of the invention;

Figure 2 is a perspective view of the transmitter and code bars of the invention;

Figure 3 is a fragmentary elevation showing the essential parts in position to transmit a marking impulse;

Figure 4 is similar to Figure 3 but positioned to send a spacing impulse;

Figure 5 is a front elevation partly in section of the transmitter of the invention;

Figures 6, 7, and 8 are vertical sectional views of a portion of the apparatus showing various operative positions assumed by the mechanism; and

Figure 9 is a cross sectional view showing the details of the contact mechanism.

In order to simplify the drawings, a considerable portion of the frame structure has been omitted. Also various springs which would normally be employed for restoring various operating parts to normal have been omitted or shown schematically in order to avoid complicating the drawings. It is to be understood, however, that suitable supporting means may be provided for the transmitter mechanism, and that suitable springs may be provided wherever necessary for assisting in the operation of parts and for restoring the various parts to normal.

Keyboard transmitter

The preferred embodiment of this invention utilizes an electrical transmitting device comprising a single set of contacts, instead of the usual distributor member, operated by a rotatable cam drum which is released for one-half revolution at a time by the actuation of any of the keys. During this one-half revolution of the cam drum the contacts are actuated to transmit a code group of impulses which represent the character of the key actuated. The rotatable cam member is stopped and started for each character code group transmitted and a non-repeat mechanism is provided to prevent repeated transmittal of the same code group if the key is held depressed for too long a time. However, another mechanism is provided to render the non-repeat mechanism inoperative when the space-bar is actuated so that the spacing operation will be repeated until the space-bar is released. The rotatable cam drum is normally prevented from rotating by a stop latch which is controlled by a universal bar that operates each time a key or the space-bar is depressed, and means are provided for regulating the amount of movement between the universal bar and the stop latch. Other means controlled by the cam drum during its rotation return the stop latch to its normal position so that it will be effective to stop the rotation of the cam drum upon its completing one-half revolution. The keys, key levers and transmitter are assembled as a complete unit on a frame which is secured to the printer frame in a manner to permit its easy removal to allow the interchange of keyboard and printer units.

The rotatable cam drum actuates selector levers in one of two varieties of motion to open or close the associated electrical contacts. These selector levers or fingers as well as certain other parts are identical to parts disclosed in copending application Serial No. 190,359, cited hereinbefore, and the same principles of operation are applied in both mechanisms. These same parts are designed for use in various other types of tape and page printers, and the manufacturing and maintenance costs of all such mechanisms using these same parts are greatly reduced because quantity production methods may be used to produce the interchangeable parts.

The preferred embodiment of this invention utilizes an electrical transmitting device selectively responsive to the actuation of finger keys **50** (Fig. 1) arranged substantially like the keys of the ordinary typewriter and attached to the upturned ends of key or control levers **52** which pass thru aligning and guiding slots in a comb member **54**, keyboard frame member **56** and a rear frame comb member **58** (see Fig. 1). The keyboard may be removably secured to the printer frame in any suitable manner. Springs **60** are secured between the key levers **52** and a turned over portion of comb member **58** and cooperate with notches in the upper edge of the key levers to position them in the slots and to pull them upwardly in a manner well known in the art. A stop strip **62** is secured on the back of comb **54** and above the key levers **52** to restrain the key levers in their upward movement. When a key **50** is depressed against the tension of a spring **60** the associated key lever **52** positions a series of permutation bars **64**, **66**, **68**, **70** and **72** in various combinations which represent, according to a predetermined arrangement, the character assigned to the particular key **50** depressed. The permutation bars **64**, **66**, **68**, **70** and **72** are provided with beveled notches **74** (Fig. 2) cut therein in a manner well known in the art which allow the bars to be cammed into position by the operation of a key lever **52**.

The permutation bars have elongated slots **76** at their ends which surround mounting studs **78**, secured in the frame in any suitable manner and provided with spacing collars **80** for positioning the bars, so that the bars are free to move transversely under the key levers **52** to either one of two positions. The notches **74** in each bar have variously arranged inclined faces, one such face being provided on each bar for each key lever **52**, so that each bar is adapted to be moved to its right hand position by some of the keys and to its left hand position by the other keys to set the bars into different combinations. A universal bar **82** mounted adjacent the first permutation bar **64** is provided with notches **84**, each having a similarly inclined face, so that the universal bar **82** is always moved to its right hand position whenever any key **50** is actuated.

Each permutation bar is provided at its right end with a notch **86** (Fig. 4) in its upper edge which engages the lower end of a corresponding blocking latch **88** as shown in Fig. 2. The five blocking latches or levers **88** extend upwardly and are mounted upon a common pivotal support **90** secured to the frame **56**. The blocking latches **88** control a set of contact operating selector levers **92** and each is provided with a hooked lug **94** at its upper end which, as the associated permutation bar is shifted, is rocked into or out of position above the

hooked end 96 of the corresponding selector lever 92 to block or unblock the lever and thereby determine the subsequent movement imparted to the lever by the cam with which it is associated as will be later explained. A bracket 98 having a turned up comb portion for supporting and guiding the blocking latches 88 is secured by some suitable means as screws 99 to the keyboard frame member 56.

A transmitter cam shaft 100 is journalled in a boss 102 of the frame member 56 and connected through a friction clutch 104, of a type well known in the art, to a shaft 106 (see Fig. 1) rotatably connected to a constantly rotating drive shaft of an electric motor (not shown). The motor is provided with a suitable governor for maintaining the motor speed constant, the governor being provided with suitable means by which the speed of the motor may be regulated. Such a governor is disclosed in copending application Serial Number 160,687, filed May 8, 1950, by Carl P. Anderson, now U. S. Patent No. 2,617,904.

Secured to the camshaft 100 (Fig. 5) is a cam drum 108 provided with a series of cam sections arranged helically around the drum to successively engage and operate the selector levers 92. In the particular embodiment of the invention herein disclosed, seven selector levers 92 are provided, one for the start impulse, five for the code impulses, and one for the stop impulse. A cam section is provided for each of the selector levers 92, and in addition a restoring cam section and a latch cam section are provided for purposes hereinafter disclosed. It is to be understood that the number of permutation bars, blocking levers 88, selector levers 92, and cam sections is not limited to the number disclosed herein but that the number is variable and determined by the number of current impulses comprising the particular code in use. Each of the cam sections has a pair of diametrically opposed raised portions or cam lobes 110 which, due to the helical arrangement of the cam sections on the cam drum 108, successively engage their associated selector levers 92 once during each one-half revolution of the cam drum. This in turn permits the transmittal of code signals for two characters during each revolution of the cam drum 108. It will be understood, of course, that it is possible to transmit more than two characters per revolution of the cam drum by providing more than two cam lobes 110 for each cam section.

Referring to Figures 2 and 5–8, the mechanism for controlling rotation of the cam drum during signal transmission, including a device for blocking repeat transmissions by inadvertent holding down of a key lever, and a device for disenabling the repeat blocking means by depressing the space bar for repeat transmission of spaces, will be described. The transmitter camshaft 100 and cam drum 108 are normally held against rotatable movement by a latch or yieldable stop 112 which is pivoted on pivot post 114 and has shoulder 116 arranged to engage either of the two stops 118 formed in the front cam section of the cam drum 108 preventing drum rotation and causing friction clutch 104 to slip. A spring 120 fastened between the machine frame and the latch 112 tends to bias the latch out of the path of stop 118 and thereby permit the cam drum 108 to rotate, but latch movement under spring bias is normally restrained by the end 121 of the latch which is turned sideways and engages the blocking lug 122 of a clutch release lever 124 pivoted on a stud 126 secured in the keyboard frame 56. An adjusting screw 128 is in threaded engagement with the clutch release lever 124 and the end of the screw engages the universal bar 82 to permit the lever 124 to be adjusted relative to the universal bar 82. A spring 130 fastened between a turned over edge 132 of the lever 124 and the frame 56 tends to force the universal bar 82 to the left and to maintain the blocking lug 122 of lever 124 under the end 121 of the yieldable stop 112 as shown in Figs. 2 and 5 of the drawings. The adjusting screw 128 permits the release lever 124 to be adjusted relative to the universal bar 82 whereby the amount of movement of the universal bar 82 necessary to effect the operation of the tripping means may be made variable and extremely slight. A repeat blocking lever 136 is pivoted on pin 126 with the clutch release lever 124 and also has a blocking lug 134 substantially coextensive with the release lever blocking lug 122 but extending a few thousandths of an inch higher than the top of lug 122. Locking lever 136 is biased by a spring 138 connected between an ear 140 on the blocking lever and an ear 142 on the release lever 124 so its blocking lug 134 normally engages the adjacent side of blocking lug 122, shown in Figure 5.

As explained above, when a key 50 is depressed its associated key lever 52 engages the inclined face in a notch in the universal bar 82 which invariably moves to the right. This movement of the universal bar 82 pivots the release lever 124 together with the blocking lever 136 counterclockwise against the tension of spring 130. The blocking lug 122 of release lever 124 moves to the left away from blocking engagement with the yieldable stop latch end 121. Since the blocking lug 134 of the repeat blocking lever 136 extends slightly above blocking lug 122, continued movement of lever 136 to the left is prevented by engagement with the side face of the stop latch end 121, as shown in Figure 7, however its spring connection with the release lever continues to bias the repeat blocking lever 136 counterclockwise. When blocking lug 122 has been moved out from under the stop latch end 121, the stop latch 112 can move clockwise under the bias of spring 120 a short distance which while still maintaining engagement with and preventing further clockwise movement of the repeat blocking lever 136 is sufficient to remove the shoulder 116 from engagement with the stop 118 on the cam drum 108 which will rotate due to its connection thru the friction clutch 104 to the constantly rotating motor. As the cams on the cam drum 108 are double, i. e., have diametrally disposed raised portions, a transmission of code signals is accomplished during each one-half of a cam drum revolution. The stop latch 112 as will now be described, is arranged to be automatically reset to stop the drum rotation at the end of each one-half revolution.

When the five code cams have completed their functions cycle, described hereinafter, a cam follower 190 on a locking bail 186 integral with the stop latch 112, is engaged by a restoring cam lobe 110 on the cam drum (Figure 5) causing a counterclockwise pivoting of the latch 112. As latch 112 moves counterclockwise against the bias of spring 120 its shoulder 116 is moved into the path of a cam drum stop 118 to thereupon stop the rotation of the cam drum by friction clutch 104. Since there are two restoring cam lobes and two cam drum stops the function just described occurs during each one-half revolution of the drum. Restoring movement of the stop latch 112 raises its end 121 above the top of blocking lug 122 on the clutch release lever 124. If the depressed key 50 has been released by the operator the spring 130 will move release lever 124 in a clockwise direction on the pivot post 126 since the universal bar under bias of a spring 192, secured between the machine frame and the universal bar 82, is moved to the left to a normal position whenever the depressed key is released and regardless of the position of latch 112 and lever 124. Clockwise movement of lever 124 upon raising of the stop latch end 121 will again place blocking lug 122 under end 121 to hold the stop latch 112 in position to lock the cam drum 108 against further rotation. The arrangement of the universal bar spring 192 makes the universal bar operation more positive since it is not dependent for movement upon lifting of the latch 112

near the completion of rotation of the cam shaft. Furthermore an early return of the universal bar **82** to its normal position assures its readiness for a subsequent operation of another key. Depression of a subsequent key will again move the universal bar **82** to the right pivoting the release lever **124** counterclockwise to release its blocking action on the stop latch **112** again initiating cam drum rotation.

Repeat transmission block

A second or repeat transmission of the same set of code signals cannot be accomplished by holding the key in a depressed position. Such repeat signals are prevented by the repeat blocking lever **136**. If key **50** is still depressed when the transmitter completes a code signal transmission, the universal bar **82** will still be in its operated position and the blocking lug **122** of the release lever **124** will be maintained in its operated position as shown in Figure 7. As the end **121** of the stop latch **112** is raised by the action of the restoring cam, as explained above, the repeat block lever **136** will no longer be engaged by latch end **121** hence it will be pulled counterclockwise by spring **138** to the position shown in Figure 8 which positions the blocking lug **134** under the end **121** of stop latch **112** to prevent the stop latch end **121** from moving downwardly under spring bias to release its stop shoulder **116** from the cam drum stop **118**. A subsequent release of the key **50** will permit springs **192** and **130** to return the universal bar together with the release lever **124** to their normal positions, as shown in Figure 5, with the end **121** of stop latch **112** again resting on the release lever blocking lug **122**. It is thus seen that to accomplish a repeat transmission of a character it will be necessary to release the operated key **50** and then reoperate it to start another cycle of transmission operation similar to that described in the foregoing paragraphs.

Repeat transmission for space bar

The space bar **194** (Figure 1) is supported by arms **196**, secured thereto in any suitable manner, which are pivoted upon a rod **198** fastened on the cone **54**. A space bar operating bar **200** is slidably pivoted at one end **202** on one arm **196** and is otherwise positioned and mounted like any key bar **52** and performs similar functions. When space bar **194** is depressed the bar **200** moves the universal bar **82** and permutation bar **68** to the right and bars **64**, **66**, **70** and **72** to the left in accordance with the Baudot code. This will permit the cam drum **108** to rotate to transmit the proper code signals for the spacing operation. The operation will be the same as described above until the restoring cam operates the restoring lever **186** to raise the end **121** of the latch **112**. When the space bar operating bar **200** was depressed it engaged an off-set end **204**, Figures 5 through 8, of a repeat lever **206** and moved it counterclockwise (Figure 6) about the pivot **208**. This action raises the toe **210** of a leg portion of lever **206** into engagement with an ear **212** integrally formed on the repeat blocking lever **136** and will thus hold the repeat blocking lever against the pull of spring **138** when the end **121** of stop latch **112** is raised away from holding engagement with the repeat blocking lug **134** by action of the restoring cam. Consequently, when the restoring cam lobe passes the cam follower **190** the latch **112** will again be operated by the pull of spring **120** and its end **121** will again be positioned between the blocking lugs **122** and **134** as seen in Figure 6. The spacing operation will be repeated so long as the spaced bar **194** is held depressed and when it is released the universal bar **82** is moved to its left by the stored energy of spring **192** and spring **130** will pivot the lever **124** to again place the blocking lug **122** under the latch end **121** to hold the latch **112** in a stop position thus preventing continued rotation of the cam drum **108**.

The selector levers **92** each have upturned portions **144** and **146** (Figs. 3 and 4) adjacent their respective ends, a cam follower **148**, and depending portions **150** and **152** which fit around a squared shoe **153** on pivot post **114**. A spring **154** is secured between the machine frame and the portion **152** of each lever **92** to normally hold the lever against the shoe **153** on the pivot post **114** and a stop **156** secured to frame **56**. The turned up portions **144** and **146** engage and position a contact bail **158** pivoted at **160** and provided with a pair of contacts **162** and **164** which cooperate with contacts **166** and **168** respectively to control the condition of the line circuit of the associated telegraph system.

Contact supports **170** and **172** (Fig. 9) are adjustable screws engaging terminals **173** fitted into an insulated supporting block **174**. The contacts **166** and **168** are plungers which are pressed forward by coiled springs **175** positioned between shoulders **176** formed on the contact plungers and guide plugs **177** screwed into the upper portion of the contact supports **170** and **172**. The contact supports may be turned in and out until the contacts **166** and **168** are in the proper relationship with the contacts **162** and **164** and set screws **178**, only one of which is shown, may be set to maintain the adjustment. It is to be noted that the contact bail **158** is not biased or spring pressed in one direction as is usual in mechanism of this type but is operated solely by positive mechanical means which assures positive operation in the manner desired. The contact bail **158** is engaged near its ends by the upturned portions **144** and **146** of the transmitter levers respectively with just sufficient clearance to permit the levers and contact bail to pivot under the control of blocking levers **88** and cam drum **108**.

In mechanically operated transmitting contacts, particularly where such contact mechanisms are operated at high speeds as required in printing telegraph signal transmitting apparatus, the prevention of contact "bounce" has presented serious difficulties. The contact mechanism herein disclosed overcomes these difficulties by the use of the novel construction of contact mechanism which is described as follows: The rocking contact bail **158** is positively pressed by selector levers **92** against plunger contact members **166** and **168** which are spring pressed and slidably and frictionally mounted in adjusting screws. Exhaustive tests have demonstrated that the friction of the contact plunger in its bearing will absorb any bounce due to impact of the rocking contact bail **158** against contact plungers **166** and **168**.

As the contact **162** or **164** is raised and meets its associated contact **166** or **168** the initial shock of meeting is cushioned or absorbed by the coiled spring **175** which compresses as the plunger moves upwardly into the guide plug **177**. The distance which the contact on the bail **158** moves after it first engages its associated contact until it reaches its full extent of movement must be interrelated with the initial tension of the spring **175** and the adjusted position of the contact support **170** or **172** so that the contacts will remain in engagement throughout their prescribed movement without any intermittent opening and closing of the contacts which has become known as "bounce." The initial tension of spring **175** is fixed by its being positioned between the shoulder **176** on the contact and the guide plug **177**. This tension is not changed when the contact support is adjusted in the block **174** to determine the normal position of the contact **166** or **168** in relation to the associated contacts **162** or **164**, and is sufficient to cause the contact to remain in engagement with the bail contact during its upward movement. The contact arrangement disclosed prevents any undesired or unauthorized opening of the contacts due to "bounce" such as is usual in spring pressed contacts because the mechanical arrangement is such that

the contacts, once closed, are held firmly together until the next operation begins.

In the embodiment of the invention shown herein we provide two sets of contacts for use in a telegraph system of the polarized current type. In such a system the contacts **162** and **164** are connected in parallel by means of the flexible conductor **179** (Figs. 3 and 4) and terminal **180** to the telegraph line, and the contact **166** is connected to a current source of a certain polarity while the contact **168** is connected to a current source having the opposite polarity to that connected to contact **166**. Thus when contacts **162** and **166** are engaged current of the first polarity is connected to the telegraph line and when contacts **164** and **168** are engaged current of the opposite polarity is connected to the line. The contact bail **158** is of sufficient width to be operated by each of the selector levers **92** which are capable of motion in two directions under the control of the blocking levers **88** and cam drum **108** to determine which contacts will be engaged. Thus, if a blocking lever **88** blocks the end **96** of its associated lever **92** (Fig. 3) as the latter is engaged by its cam, the opposite end will raise upon the pivot post **114** to engage contacts **164** and **168**. If the blocking lever **88** does not block the end **96** of the selector lever **92** (Fig. 4), it will pivot upon the shoe **153** and post **114** and raise the end **144** to close contacts **162** and **166**. When the transmitter is associated with a system having only one source of current the contact **166** or the external electrical connections to contact **166** will be omitted as is well known in the art.

In a polarized system it is necessary that one or the other of the movable contacts be in engagement with its associated contact at all times to maintain current of the proper polarity on the line and therefore cams and selector levers **92** must be provided for the start and stop positions of the transmitter. The front or first cam section in Fig. 5 cooperates with the latch **112**; the second cam operates a restoring lever, to be described; the third, fourth, fifth, sixth, and seventh cams operate the five code selector levers; the eighth cam controls the "start" selector lever and the ninth cam operates the "stop" selector lever. In the stop or rest position the cam lobe **110** of the "stop" cam section raises the associated "stop" selector lever **92** and as the end of the lever is always blocked by a fixed catch **182** (Fig. 1) the lever will pivot about its right end and its lefthand upturned portion **146** will engage the left end of contact bail **158** to close contacts **164** and **168** to connect a "marking" current to the telegraph line.

The first movement of the cam drum **108** causes the lobe **110** of the "stop" cam to disengage the cam follower **148** of the "stop" selector lever **92** and immediately thereafter the lobe **110** of the "start" cam engages the cam follower **148** of the "start" selector lever **92** and as there is no blocking or latching member provided for the "start" selector lever it will invariably pivot on post **114** raising its right (Fig. 4) or unblocked end to cause the up-turned portion **144** to press the contact bail **158** upwardly, as in Fig. 4. Bail **158** will pivot at **160** to close contacts **162** and **166** and open contacts **164** and **168** and thereby place the associated telegraph line in a "start" condition. The cam drum **108** continues to rotate and successively operates the five code selector levers **92** to control the position of the contact bail **158** in accordance with the blocked or unblocked condition of the levers.

Thus if the key **50** which corresponds to the letter "Y" is depressed permutation bars **64**, **68**, and **72** will be moved to the right and bars **66** and **70** will be moved to the left. The blocking levers or latches **88** associated with the respective bars assume corresponding positions with the first, third, and fifth levers in their latching or blocking position and the second and fourth in their unblocking position. The blocking levers **88** are held in their respective positions by a knife edge **184** (Figs. 1 and 5) formed on the end of the restoring locking bail **186** which is an integrally formed angularly displaced portion of the latch **112**. The knife edge **184** is moved by the pivotal movement of the latch **112** into engagement with the ears **188** on the ends of the respective blocking levers **88** to hold them in position until a complete code is sent by the transmitter. The depression of another key **50** will not be effective to set up another code as the blocking levers **88** cannot move until the code for the first character is completely transmitted.

As the cam drum **108** continues to rotate the first code cam engages the cam follower **148** on the first code selector lever **92** which has its right end blocked by the first latch **88** (Fig. 3) so as its cam follower **148** rides up on the lobe **110** of the cam the right end of the lever will be held down to act as a pivot whereby the portion **146** will press the contact bail **158** upwardly to close contacts **164** and **168** and open contacts **162** and **166** which were previously closed by the operation of the start selector lever **92**. By the time the cam follower **148** of the first code selector lever **92** is engaged by its associated cam the cam lobe **110** for the start lever has passed beyond the start cam follower so the contact bail **158** is free to move under the influence of the first code lever. The second code lever **92** does not have its end blocked (see Fig. 4) and therefore pivots on the post **114** to raise the right end of contact bail **158** to open contacts **164** and **168** and close contacts **162** and **166** to place the line in a "space" condition. As the code levers **92** are successively engaged they will operate the transmitter contacts to alternatively (for the letter "Y") place marking or spacing current (or current or no-current) on the telegraph line in accordance with the blocked or unblocked condition of the levers. Immediately upon the operation of the final, in this case the fifth, code selector lever **92** the restoring cam lobe **110** engages the cam follower **190** (Figs. 2 and 5) on the restoring locking bail **186** which pivots on post **114** and disengages the knife edge **184** from the ears **188** of the blocking levers **88** so that they may be moved by the depression of a key **50** to set up the transmitter for the sending of another code signal. The restoring bail **186**, as previously described, is integrally formed with latch **112** and as latch **112** is pivoted by the restoring bail its shoulder **116** is moved into the path of the cam stop **118** to stop the rotation of the cam stop **108** upon their engagement. At this time the "stop" selector lever **92** is in an operated position and contacts **164** and **168** are closed to place the line in a "mark" condition.

From the foregoing description it will be apparent that the novel invention disclosed herein provides a reliable keyboard transmitter mechanism operating at a comparatively slow speed but transmitting code signals at high speed. At the same time the transmitter is compact and very durable and provides a novel construction and arrangement of elements which overcome to a large extent the difficulties and drawbacks of the prior art.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In a keyboard transmitter, a set of key levers, an independently rotatable member, a series of contact operating levers having two alternatively selectable oppositely directed paths of motion, a pair of current controlling contacts common to said series of contact operating levers, means operable upon actuation of a contact operating lever in one of its paths of motion to move said contacts toward each other and upon actuation of a contact operating lever in the other of its paths of motion to move

said contacts away from each other, means operable by said rotatable member to sequentially actuate said contact operating levers in one of said oppositely directed paths of motion, and means controlled by the actuation of one of said key levers to restrain the movement of a portion of said contact operating levers in said first path of motion and to compel the movement thereof in a second path of motion whereby said pair of contacts is actuated in a predetermined manner to correspond to the actuated key lever.

2. In a telegraph keyboard transmitter, a set of key levers, a universal bar invariably operated on the actuation of any one of said key levers, a rotatable mechanism, wholly mechanical linkage means, including said universal bar, structurally cooperating with said rotatable mechanism, responsive to the depression of one of said key levers to initiate the rotation of said rotatable mechanism, means operated by said rotatable mechanism to stop the rotation thereof at the end of each one-half revolution, and resilient means effective upon the release of the actuated key lever to restore said universal bar to its normal position.

3. In a telegraph transmitter, a group of control levers, a rotatable member with a plurality of diametrally double cams prearranged thereon, means for rotating said member, means for rendering said last mentioned means operable, a plurality of rockable blocking latch members controlled by actuation of one of said control levers, a pair of current controlling contacts, a pivotable bail for supporting one of said contacts, a plurality of levers the movement of each of which is controlled by an individual one of said blocking latch members and which are sequentially engaged by the cams of said rotatable member during the rotation for positively operating said contact bail to engage and to disengage said contacts in combinations according to a code combination for the actuated control lever, and means associated with said rotatable member for stopping rotation thereof at the end of each one-half revolution after the code combination has been transmitted.

4. A device as defined in claim 3, wherein said contact bail operating levers are so mounted as to pivot about either of two points thereon upon engagement by said rotatable member, the pivot point depending upon whether said levers are blocked or unblocked by said rockable blocking members.

5. In a device as defined in claim 3, said contact bail operating levers having means adjacent the respective ends of said levers for positively operating said contact and preventing unauthorized movement thereof.

6. A device as defined in claim 3, wherein said contact bail is common to all of said contact bail operating levers.

7. A device as defined in claim 3, wherein said contact bail is equal in width to the combined widths of said contact bail operating levers and the total width of the spaces between each adjacent pair of said contact bail operating levers.

8. In a telegraph transmitter, a group of key levers, a universal bar adapted to be operated by any one of said key levers, a rotatable mechanism, means controlled by said universal bar upon operation by a key lever to initiate the rotation of said rotatable mechanism, means operated by said rotatable mechanism to stop the rotation thereof at the end of each one-half revolution, and means controlled by said rotatable mechanism and cooperating with said universal bar to prevent subsequent operation of a key lever during the rotation of the rotatable mechanism.

9. In a telegraph transmitter, a rotatable member, means for rotating said member, a plurality of rockable blocking members, a pair of contacts, a set of contact operating levers having two varieties of motion controlled by said blocking members in predetermined combinations and sequentially operated by said rotatable member to engage said contacts, said contacts being common to all of said contact operating levers, and resilient means operable to maintain said contacts in engagement.

10. In a telegraph keyboard, a set of key levers, a universal bar invariably operated on the actuation of any one of said key levers, a power driven rotatable member, a yieldable stop, a first blocking member for said a stop, means including said yieldable stop and said first blocking member for holding said rotatable member at rest in a normal position, said first blocking member movable on the actuation of said universal bar to unblock said yieldable stop to permit the rotation of said rotatable member, means operated by said rotatable member during rotation thereof to move said yieldable stop to a stop position, a second blocking member for holding said yieldable stop in said stop position to prevent further rotation of said rotatable member, and means for rendering said second blocking member inoperative to permit the continued operation of said rotatable member.

11. In a telegraph keyboard transmitter, a rotatable member normally tending to rotate, a yieldable stop latch to hold said member against rotation, a first blocking member for blocking yielding movement of said stop latch, a set of key levers, a universal bar invariably operated on the actuation of any of said key levers to move said blocking member and unblock said yieldable stop latch to permit rotatation of said rotatable member, means associated with said rotatable member for moving said yieldable latch to latching position after each one-half revolution of said member, a second blocking member for said latch, means for operating said second blocking member to block yielding movement of said latch when said first blocking member is held in its unblocking position, thereby preventing further operation of said rotatable member, and means for rendering said first blocking member operative and said second blocking member inoperative upon deactuation of said universal bar.

12. In a telegraph keyboard transmitter, a rotatable member normally tending to rotate, a yieldable stop latch normally holding said member from rotation, a first blocking member for blocking yielding movement of said stop latch, a set of key levers, a universal bar invariably operated on the actuation of any of said key levers to move said blocking member to unblocking position and thereby release said yieldable stop latch to permit rotation of said rotatable member, means associated with said rotatable member for moving said yieldable latch to latching position after each one-half revolution of said member, a second blocking member for said latch, means for operating said second blocking member for blocking yielding movement of said stop latch to hold said rotatable member against continued rotation when said first blocking member is held in its unblocking position, and means for rendering said second blocking member inoperable to permit continued operation of said rotatable member.

13. In a keyboard transmitter, a rotatable member, means to initiate rotation of said rotatable member, a plurality of contact operating levers, a pair of current transmitting contacts common to said contact operating levers, and means including one of said contacts engageable by and alternatively forced to move to the contact open and to the contact closed position by actuation of said contact operating levers, means including said rotatable member for sequentially actuating said contact operating levers within a half revolution of said rotatable member to operate said contacts in a predetermined manner to transmit a predetermined code signal, and means associated with said rotatable member and operable to stop rotation thereof at the end of each one-half revolution after said code signal has been transmitted.

14. In a telegraph printer, a rotatable member normally tending to rotate, a yieldable stop latch normally holding said member from rotation, a first blocking member for blocking yielding movement of said stop latch, a

set of key levers, a universal bar invariably operated on the actuation of any of said key levers to move said blocking member to unblocking position and thereby release said yieldable stop latch to permit rotation of said rotatable member, means associated with said rotatable member for moving said yieldable latch to latching position after one-half revolution of said member, a second blocking member for said latch resiliently connected to said first blocking member for movement therewith to a position to block yielding movement of said stop latch to hold said rotatable member against continued rotation when said first blocking member is held in its unblocking position, and means for rendering said second blocking member inoperable to permit continued operation of said rotatable member.

15. In a telegraph printer, a rotatable member normally tending to rotate, a yieldable stop latch normally holding said member from rotation, a first blocking member for blocking yielding movement of said stop latch, a set of key levers, a universal bar invariably operated on the actuation of any of said key levers to move said blocking member to unblocking position and thereby release said yieldable stop latch to permit rotation of said rotatable member, means associated with said rotatable member for moving said yieldable latch to latching position after one-half revolution of said member, a second blocking member for said latch, resiliently connected to said first blocking member for movement therewith to a position to block yielding movement of said stop latch to hold said rotatable member against continued rotation when said first blocking member is held in its unblocking position, and means controlled by actuation of at least one of said key levers for rendering said second blocking member inoperable to permit continued operation of said rotatable member.

16. In a telegraph printer, a rotatable member normally tending to rotate, a yieldable stop latch normally holding said member from rotation, a first blocking member for blocking yielding movement of said stop latch, a set of key levers, a universal bar invariably operated on the actuation of any of said key levers to move said blocking member to unblocking position and thereby release said yieldable stop latch to permit rotation of said rotatable member, means associated with said rotatable member for moving said yieldable latch to latching position after one-half revolution of said member, a second blocking member for said latch resiliently connected to said first blocking member for movement therewith to a position to block yielding movement of said stop latch to hold said rotatable member against continued rotation when said first blocking member is held in its unblocking position, and means for rendering said second blocking member inoperable to permit continued operation of said rotatable member comprising a member selectively operative to engage said second blocking member in opposition to the resilient connection between said blocking members to prevent movement of said second blocking member to its blocking position.

17. A transmitting mechanism comprising a fixed transmitting contact, a bail having a contact thereon and mounted for pivoted movement between a first position of engagement of said bail contact with said fixed contact and a second position of disengagement of said contacts, a set of bail operating levers disposed on the side of said bail opposite said fixed contact and each mounted at one end for pivotal and radial sliding movement relative to a common axis spaced from and parallel to the pivot axis of said bail, a set of blocking latches permutatively settable to operative and inoperative positions, said latches when in their operative position being effective to engage the free end of one of said operating levers, and a rotatable cam member provided with offset projections on the periphery thereof operative upon rotation of said member to engage said levers sequentially intermediate their ends to impart pivotal movement about said common axis to each lever unrestrained by a blocking latch and pivotal movement about the normally free end of each lever restrained by a blocking latch to variably engage and disengage said contacts in accordance with the permutatively setting of said latches.

18. A transmitting mechanism comprising a pair of fixed transmitting contacts, a bail having a pair of contacts thereon and mounted for pivotal movement between a first position of engagement of one of said bail contacts with one of said fixed contacts and a second position of engagement of the other of said bail contacts with the other of said fixed contacts, a set of bail operating levers disposed on the side of said bail opposite said fixed contacts and each mounted at one end for pivotal and radial sliding movement relative to a common axis spaced from and parallel to the pivot axis of said bail, a set of blocking latches permutatively settable to operative and inoperative positions, said latches when in their operative position being effective to engage the free end of one of said operating levers, and a rotatable cam member provided with offset projections on the periphery thereof operative upon rotation of said member to engage said levers sequentially intermediate their ends to impart pivotal movement about said common axis to each lever unrestrained by a blocking latch and pivotal movement about the normally free end of each lever restrained by a blocking latch to variably engage said contacts in accordance with the permutative setting of said latches.

19. A keyboard transmitting mechanism comprising a group of key levers, a set of permutation bars variably positioned by actuation of said key levers, a pair of fixed transmitting contacts, a bail having a pair of contacts thereon and mounted for pivotal movement between a first position of engagement of one of said bail contacts with one of said fixed contacts and a second position of engagement of the other of said bail contacts with the other of said fixed contacts, a set of bail operating levers disposed on the side of said bail opposite said fixed contacts and each mounted at one end for pivotal and radial sliding movement relative to a common axis spaced from and parallel to the pivot axis of said bail, a set of blocking latches each individually controlled by one of said permutation bars and each operative in one position to engage the free end of one of said operating levers, and a rotatable cam member provided with offset projections on the periphery thereof operative upon rotation of said member to engage said levers sequentially intermediate their ends to impart pivotal movement about said common axis to each lever unrestrained by a blocking latch and pivotal movement about the normally free end of each lever restrained by a blocking latch to variably engage said contacts in accordance with the setting of said permutation bars.

20. In a telegraph transmitter, a set of permutatively settable pivoted blocking members each operable to one of two alternative positions indicative of a signal to be transmitted, a set of contact operating levers each normally pivotally mounted adjacent one end and each adapted to pivotally coact at its other end with an aligned one of said pivoted blocking members when in one of said alternative positions to be restrained against pivotal movement about said one end, a pair of transmitting contacts common to all of said contact operating levers, and a rotatable cam member operative to engage said levers intermediate their ends and to sequentially pivot each of said contact operating levers about one of its ends in accordance with the variable positions of said blocking members to variably operate said pair of transmitting contacts according to the signals to be transmitted.

21. In a telegraph transmitter, an independently rotatable member, a series of contact operating levers each having two alternatively selectable oppositely directed paths of motion, movable means, including a pair of current controlling contacts common to said series of contact operating levers forced to move in one direction to

close said contacts by movement of a contact operating lever in one of its paths of motion and forced to move in the contact opening direction by movement of a contact operating lever in the other of its paths of motion, means operable by said rotatable member to sequentially actuate said contact operating levers in one of their said paths of motion, and a plurality of permutatively settable means for restraining the movement of a selected group of said contact operating levers in said first path of motion and to compel the movement thereof in a second path of motion whereby said pair of contacts is actuated in a predetermined manner to correspond to the permutative setting of said permutatively settable means.

22. A permutation keyboard mechanism comprising a group of key levers, a set of permutation bars variable positioned by actuation of said key levers, a set of pivoted blocking members each operated by said permutation bars to one of two alternative positions, a set of contact operating levers each normally pivotally mounted adjacent one end and each adapted to pivotally coact at its other end with an aligned one of said pivoted blocking members when in one of said alternative positions, a pair of transmitting contacts common to all of said contact operating levers, and a rotatable cam member to sequentially operate each of said contact operating levers about one of its ends in accordance with the variable positions of said blocking members to variably engage said pair of transmitting contacts according to the signal to be transmitted.

23. In a telegraph keyboard: a set of key levers; a universal bar invariably operated upon actuation of any one of said key levers; a power driven rotatable member; a yieldable stop; a first blocking member for said stop; means including said yieldable stop and said first blocking member for holding said rotatable member at rest in a normal position, said blocking member being movable on the actuation of said universal bar to unblock said yieldable stop to permit the rotation of said rotatable member; means operated by said rotatable member during rotation thereof to move said yieldable stop to a stop position; means including said first blocking member and a second blocking member rendered operative when said universal bar is retained in actuated position during rotation of said rotatable member for holding said yieldable stop in said stop position by said second blocking member to prevent further rotation of said rotatable member and upon deactivation of said universal bar for rendering said first blocking member operative to hold said rotatable member at normal rest position and removing said second blocking member from its blocking position.

24. A telegraph printer comprising: a rotatable member; means for rotating said member; a plurality of rockable blocking members; a pair of contacts comprising a movable contact, a second contact, a support for said second contact, a support for said second contact adjustable to regulate the normal relationship of said contacts, and resilient means associated with said second contact and said support for absorbing the shock of contact engagement and preventing undesirable disengagement of said contacts; and a set of contact operating levers having two varieties of motion controlled by said blocking members in predetermined combinations and sequentially operated by said rotatable member to engage and disengage said contacts, said contacts being common to all of said contact operating levers.

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